

particles of oxides and to improve the high-temperature creep strength. Applicants have discovered that the co-addition of Y_2O_3 and Ti is the best for providing such effect.

Applicants' claim 1 is directed to the co-addition of Y_2O_3 and Ti, which is most effective in finely and densely dispersing the oxide particles. This is surprising, because the addition of Ti to ODS strengthened steel causes a problem. Specifically, Ti combines with C in the matrix to form a carbide, causing the C concentration in the matrix to decrease, and making it impossible to ensure a sufficient amount of α to γ transformation during austenitization heat treatment. When untransformed α -phase is retained, a coarse grain structure effective in improving high-temperature creep strength cannot be formed by slow cooling. However, as recited in Applicants' claim 1, TiO_2 powder is used as an element powder of a Ti component, so that an excess oxygen content in the steel satisfies a predetermined range. This allows an ODS ferritic steel having a coarse grain structure to be obtained, even when the co-addition of Y_2O_3 and Ti is employed.

On the other hand, the Lambard et al. reference relates to a method of manufacturing an ODS ferritic steel having a coarse grain structure wherein generally known stable oxides are added. Further, the reference does not address the concern which arises when Ti is added to an ODS ferritic steel. Therefore, the reference fails to teach or suggest Applicants' solution to this problem: the use of TiO_2 powder as an element powder of Ti component and the control of excess oxygen content within the predetermined range.

The examples of Lambard et al. describe formation of coarse grains and the improvement of high-temperature strength of a sample material of ODS ferritic steel (EM10 + Y_2O_3 ODS). However, none of the examples involve the addition of the Ti component. Even if one of ordinary skill in the art tried the co-addition of Y_2O_3 and Ti, based on the general teachings of Lambard et al., the effect of grain coarsening would not be obtained, because the excess oxygen content is not controlled within the predetermined range. This is exemplified in the comparative T14, as discussed in Table 1 and page 16, lines 9-18 of Applicants' specification.

On the contrary, in the test example of the present invention, Applicants demonstrate that the high-temperature creep strength is improved in the sample T7, in

which the co-addition of Y₂O₃ and Ti is employed and TiO₂ powder is used as an element powder of Ti component so that the excess oxygen content satisfies the predetermined range. (See Fig. 5 and page 19, line 13 to page 20, line 13 of Applicants' specification.)

In summary, Lambard et al. neither teach nor suggest that the excess oxygen content in steel has an important effect on formation of coarse grains when the combined addition of Y₂O₃ and Ti is employed. Nor does the reference teach or suggest the use of TiO₂ powder a an element powder of Ti component to enable the control of excess oxygen content within the predetermined range.

For these reasons, the invention of claim 1 is clearly patentable over Lambard et al.

The allowance of claim 2 is noted.

Therefore, in view of the foregoing amendments and remarks, it is submitted that the ground of rejection set forth by the Examiner has been overcome, and that the application is in condition for allowance. Such allowance is solicited.

Respectfully submitted,

Satoshi OHTSUKA et al.

By: 
Amy E. Pulliam
Registration No. 55,965
Attorney for Applicants

AEP/nrj
Washington, D.C. 20006-1021
Telephone (202) 721-8200
Facsimile (202) 721-8250
March 27, 2006